Comments on Blue Ribbon Commission (BRC) Draft Report

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The draft BRC report represents a lot of work and provides a useful overview of the issues and many good recommendations. The comments below relate to issues that are either not considered, where additional work or clarification would be useful, or where I question the thrust of a recommendation.

Executive Summary[1]

Conclusion 5: **"Prompt efforts to develop one or more consolidated interim storage facilities."** The BRC should be clearer on the scale of consolidated interim storage facilities that it is recommending. Dry cask storage at nuclear power plants with operating reactors costs no more to secure and maintain than dry cask storage at central storage sites and keeping it on-site minimizes unnecessary spent-fuel transport. As the BRC report makes clear (see e.g. Fig. 16), the economic benefits are clearer for fuel at nuclear power plants with no operating reactors. The draft report makes other arguments for including fuel from operating power plants in consolidated storage but I find them much less compelling and urge reconsideration given the possibility that consolidate storage proposals could morph into reprocessing proposals as happened in Japan and may be happening in South Korea.

Although there is a discussion of Private Fuel Storage at pp. 25, 26, there is none in the Executive Summary. Given the importance the BRC assigns to consolidated storage, it BRC should discuss at greater length the lessons to be learned from this important case – as well as the history of failed federal efforts to site a Monitored Retrievable Storage Facility.

"[N]on-proliferation concerns" are the last words in the discussion of conclusion 6**. "Support for Advances in Nuclear Energy Technology and for Workforce Development"** – making them appear almost an after-thought. But this should be the highest priority consideration in deciding on R&D directions. Fuel cycle design and institutional arrangements have been central issue in U.S. non-proliferation policy since the 1946 Acheson-Lilienthal report and India's 1974 misuse of U.S. and Canadian Atoms for Peace assistance to make and test a nuclear explosive.

In non-proliferation and cost terms, the U.S. could do a lot worse than the current "once-through" fuel cycle. Unfortunately, a considerable portion of past U.S. nuclear-energy R&D has focused on technologies – notably fast-neutron reactors and their closed fuel cycle – that would be worse from a non-proliferation perspective as well as being more costly.

p. xi. **"These liabilities are already in the billions of dollars and are projected to increase by $500 million for each additional year of delay."** The American Physical

[1] **Note:** Points made with regard to the Executive Summary are not repeated with regard to the corresponding sections.

Society was unable to obtain from the DOE the basis for this estimate.[2] A back-of-the-envelope calculation dividing $500 million by 2,000 tons of spent fuel discharged per year yields $250/kg. Dry casks cost about $100/kg. There are also other costs but I have been unable to find a plausible explanation of an estimate as high as $250/kg. The BRC ought to be able to determine from the settlements to date, what the average settlement has been per kg and what the breakdown is, including for utility lawyers.

p. 18. "The FRR…accepts highly-enriched fuel from research reactors in other countries." The DOE also accepts some LEU foreign research reactor fuel as part of its effort to encourage conversion to LEU.

p. 27. **"Subsequently, eight other states adopted statutes that tied approval of new reactors to (at a minimum) progress on the issue of waste disposal."** The states should be listed.

p. 41. **"These cost advantages will only grow as increasing numbers of reactors reach the end of their operating lives, starting around 2030. Assuming a 60-year operating life, on average, for current plants, the number of shutdown sites could reach 30 by 2035 and 70 by 2050."** It should be stated that this assumes that no replacement reactors will be built on these sites. Since existing sites are the easiest places to build new reactors, this would be likely only if there are no new nuclear power reactors built in the U.S.

p. 42. **"As with developing permanent disposal capability, the critical challenge for consolidated storage will be finding a site or sites. Because the technical requirements for this type of facility would be less demanding than for a repository, finding a suitable location with an accepting host community should be less difficult, particularly if it is accompanied by attractive incentives."** It should be noted that, in Japan, the incentive that was required by Aomori Prefecture was a commitment to build a reprocessing plant. Some communities in the U.S. – for example, those around the DOE's Savannah River site – would likely require such a commitment.

p. 53. "**The Hardened On-Site Storage (HOSS) Concept."** It should be mentioned that Germany and Japan and perhaps other countries already store dry casks in thick reinforced-concrete buildings. In the case of Germany, one purpose is to protect the casks against aircraft crashes and also anti-tank missiles. Another purpose is to reduce radiation to passers by because the site boundaries are closer than in the U.S.

p. 55. **"In 2006, the NAS *Going the Distance* report noted that '[m]alevolent acts against spent fuel and HLW are a major technical and societal concern.' However, the report authors were unable to perform an in-depth analysis of transportation security due to informational constraints (primarily lack of access to classified materials). Accordingly, the committee recommended that experts with full access to all relevant information conduct an independent assessment of security risks before any large-scale campaign to ship materials to a disposal or consolidated interim storage facility is launched.**

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[2] *Consolidated Interim Storage of Commercial Spent Nuclear Fuel: A Technical and Programmatic Assessment,* American Physical Society, Panel on Public Affairs, February 2007, Appendix III.

"In subsequent discussions with the NRC's Office of Nuclear Security and Incident Response, BRC Commissioners and staff reviewed the additional analyses NRC has conducted following the release of the NAS report and others developed since that time. We found that the NRC has taken reasonable actions to respond to the vulnerabilities that have been identified to date and we expect the current NRC rulemaking process to be sufficient to ensure that any needed future changes will be made appropriately."

The BRC here appears to be agreeing with the NRC that no independent study is required of the concerns raised in the NAS study. By independent, the NAS committee obviously meant independent from the NRC. Has the BRC discussed this conclusion with the NAS Committee or its staff?

p. 56. **"The Commission takes no position on the Administration's request to withdraw the license application. We simply note that the U.S. inventory of SNF will soon exceed the amount that can be legally emplaced at Yucca Mountain until a second repository is in operation. So under current law, the United States will need to find a new repository site even if Yucca Mountain were to go forward."**

The BRC does not mention the possibility that Congress could lift the limit on the amount of spent fuel that could be stored in Yucca Mountain. The Bush Administration proposed doing so. I am not advocating this but it is probably worth an endnote.

p. 60. "**Of these two sites, a larger area for surface support facilities was available at Olkiluoto. In addition, because of two existing reactors at Olkiluoto, a large portion of the country's spent fuel inventory was already on the island.'**

Are you sure that the nuclear power plant is on an island? Better check.

p. 105. "**a regulatory framework and standards for deep borehole disposal facilities**." A separate issue not discussed in the BRC report is the possibility that **excess separated plutonium** might be fabricated into a durable waste form without being mixed with fission products and emplaced in deep boreholes. This possibility is discussed in the forthcoming IPFM report on spent fuel management, where it is concluded that borehole disposition of plutonium would be considerably easier than borehole disposal of either spent fuel or high-level waste.[3]

p. 106. "**the United States should offer to place all future geologic disposal facilities under IAEA safeguards monitoring."** This brief discussion should be expanded because its significance dwarfs the safety issues relating to geological repositories. Spent LWR fuel is about one percent plutonium. One hundred thousand tons of spent fuel will therefore contain about one thousand tons of plutonium or more than 100,000 "significant quantities" (weapon equivalents) by the IAEA metric (8 kg of plutonium). Loss of control over a significant quantity of plutonium would pose a potential threat to all countries. This is why the IAEA expects to monitor repositories indefinitely in non-weapon states.[4] In those states, the IAEA requires that it be informed about repository design so that it

[3] Chapter by Rodney Ewing on repository design in the forthcoming IPFM report on spent-fuel management (in press).

[4] See the chapter by Tom Shea on international safeguards on repositories in the forthcoming International Panel on Fissile Materials (IPFM) report on the management of spent fuel (*op. cit*).

can provide feedback on any features that would affect its ability to safeguard the repository. Given that the NPT weapon states, including the United States, are committed to nuclear disarmament, we should look ahead to the possibility that such IAEA safeguards will be extended to the weapon-state repositories and involve the IAEA in the review loop for the US repository design process.

Table 3, under "**Fast-Spectrum Reactor with Closed Fuel Cycle." "RD&D is needed to provide a basis for design, licensing, and evaluating long-term economic viability."** It is not clear whether or not the BRC is recommending more RD&D here. It should be noted that about $100 billion has already been spent on RD&D on this option.[5]

p. 120. "**Examples might include fast-spectrum reactors demonstrating passive safety characteristics…"** All reactor types, including fast-spectrum reactors, have some passive safety characteristics. Fast-spectrum reactors also have special safety issues, including sodium fires and the possibility of super-criticality in a melt-down. It is therefore inappropriate to single out fast-spectrum reactors as being special with regard to passive safety. Once again, $100 billion has already been spent on RD&D on this reactor type.

p. 121. **"To that end, the Commission believes that DOE's nuclear energy R&D Roadmap provides a good science-based step toward the development of an effective, long-term RD&D program."** I am not sure that I agree. It looks to me as if the Roadmap has a little bit of something for every school of thought. All options are embraced, from life extensions of existing reactors beyond 60 years to breeder reactors. But there is not enough focus to expect either much to be accomplished or much damage to be done. The DOE has not faced up to the fact that there may be a fundamental conflict between "sustainability" (i.e. reprocessing and recycle) and "proliferation resistance." It imagines that, with only enough R&D, one can have both. Also, it does not discuss the sustainability of the once-through fuel cycle. If it is good for at least a century, even with a high-nuclear-growth scenario, as I believe it is, that should have significant policy implications.

p. 127. "**All [Add: non-weapon-state] signatories to the NPT are required to have a comprehensive safeguards agreement (CSA) in place."**

pp. 128-131. "**11.2.2 Multilateral/Multi-national Fuel Cycle Services Options."** This section should include a discussion of the possibility of the U.S. setting an example by making its enrichment facilities multinational. The fact that the one new facility in operation is operated by Urenco and that the next facility that is expected to be constructed is to be built by Areva puts the U.S. in a good position to do this and to push for transparency in the operation of these facilities as far as their limitation to the production of LEU is concerned. A third proposed US enrichment facility, the laser enrichment facility that GE-Hitachi plans to build, also would have multinational attributes. The only exception is USEC's proposed centrifuge enrichment facility, and it might not be built.

[5] *Fast Breeder Reactor Programs: History and Status* (International Panel on Fissile Materials, 2010).